

# **The S/X-Band Microwave Feed System for NASA's First Beamwaveguide Antenna**

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## **SUMMARY**

The configuration, detail design, and performance of a dual S/X-band microwave feed system for the first Deep Space Network (DSN) beamwaveguide antenna is reported in this paper. Deep Space Station 13 (DSS 13), located at the Deep Space Communication Complex in Goldstone, CA, is NASA's first beamwaveguide tracking antenna. This antenna, which is primarily used for research and development tasks, is an elevation-over-azimuth type using wheel and track azimuth bearings. DSS 13 has a parabolic main reflector which is 34 m in diameter and a hyperbolic subreflector which is 3.43 m in diameter. The subreflector is supported by a low-optical cross-section tripod. The main reflector and the subreflector are both shaped to provide near uniform aperture illumination. The reflector surfaces are designed and fabricated for providing high performance at 32 GHz.

In beamwaveguide antennas, the microwave front-end equipment is placed in a large room or a basement under the main reflector structure. The microwave signal is guided from the basement to the subreflector, or vice versa, through a system of flat or curved reflectors (see Figure 1). There are several advantages in having the microwave feed equipment in the basement: the microwave equipment will be stationary at all times, ease of installation and maintenance, and the capability of using several feed systems without introducing additional loss due to the blockage,

At DSS 13, a large rotatable elliptical reflector in the basement (MS) and two flat and two parabolic reflectors in the beamwaveguide tube (M1 through M4) are used to guide the signal to the subreflector. Several different microwave feed systems are placed about the rotating ellipsoid. Each microwave feed can then be selected remotely by aligning the ellipsoid in the direction of that feed.

The S/X-band microwave feed system implemented at DSS 13 is a super low noise feed for support of deep space missions. To reduce losses, all waveguide components are fabricated from copper. This feed is capable of receiving S-, and X-band signals in both Right Hand Circularly Polarized (RCP) and Left Hand Circularly Polarized (LCP). The measured noise temperature of the feed systems is 17.5 Kelvin for S-band and 24.0 Kelvin for X-band, which agree very closely with the predicted performance.

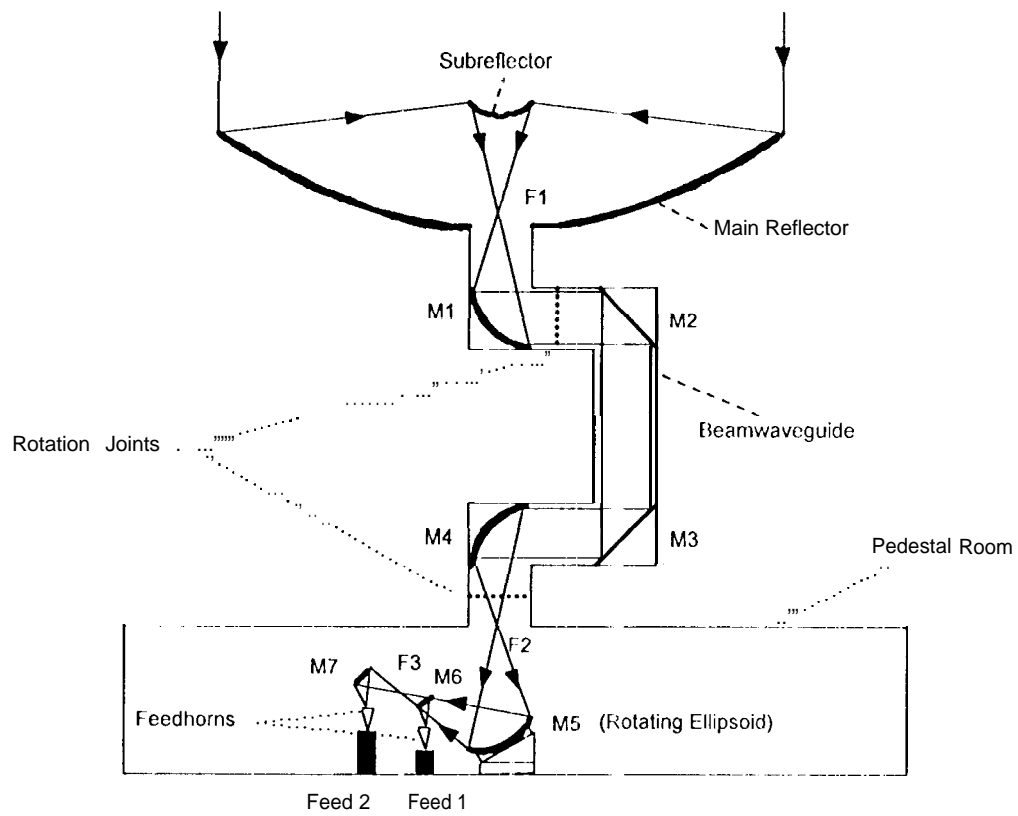


Figure 1.1) SS 13 Beamwaveguide Antenna Configuration